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THE ELECTRICAL EXPERIMENTER

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The Speaking Arc Light

By H. Winfield Secor

The Speaking Arc Light and How to Build It.

AN arc light that speaks, although not new by any means, is always of considerable interest to experimenters and forms a very excellent demonstrating device for lecturers; and besides speaking arc lights have been adapted to the announcement of train arrivals and departures in large railway stations, et cetera. To make up an experimental arc set of this type does not necessitate any great outlay, or require any extremely elaborate instruments. At Fig. 1, is outlined the commonest arrangement for a speaking arc circuit. A source of 50 volts or more and 5 to 10 amperes Direct Current, supplies a hand feed arc lamp, detailed at Fig. 2, fitted with cored carbons of ½ diameter. A rheostat R, serves to control the amount of current consumed by the arc, and one composed of 50-60 feet of No. 16 Iron Wire forms a good ballast. A neat and effective form of such an adjustable rheostat is depicted at Fig. 3, which also portrays a simple design of hand feed arc lamp; details of which are seen at Fig. 2.

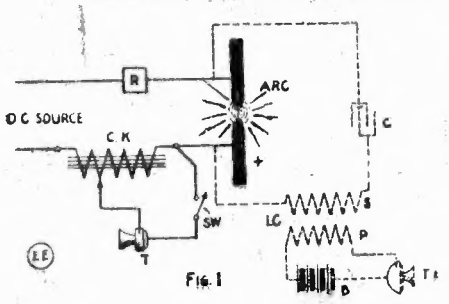

Fig. 1

A choke coil is connected in series with the arc supply circuit at C K, and across it is shunted an E. I. Co., $1.25 telephone transmitter. Not more than ¾ to 1 ampere should be passed thru it, or the current may be judged by the degree of heating in the transmitter.

It may become warm but must not be allowed to get so hot that the hand cannot be left on same. The choke coil may be composed of an iron wire core, about 6 to 7 inches long and ¾ inch in diameter, wound over with 3 layers of oiled linen or Empire cloth. Over this insulation is placed 6 to 7 layers of No. 12 or 14 B. & S. D. C.C. or enameled magnet wire, leaving out taps from the 4th, 5th and 6th layers, to permit of adjusting the inductance as desired. Fibre end cheeks may be fitted on the iron core. The rheostat aforementioned is intended for 110 volt D. C. circuits, and for 220 volt circuits, about twice the length of wire should be used.

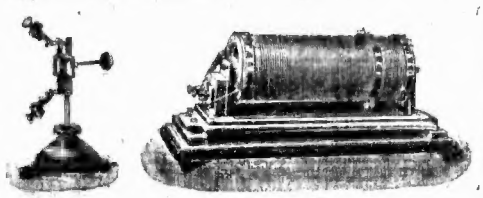
Fig. 3

Considering the microphone transmitters, a good way of mounting it, together with the choke coil and switch S.W. is shown at Fig. 4. Some operators prefer to super-impose the talking currents across the arc, as indicated in dotted lines at Fig. 1, by utilizing a ½ micro-farad condenser, (can be bought of the E. I. Co. at 80 cents), connected in series with the secondary of a telephone induction coil of 150 ohm type, I C; and in whose primary circuit is connected the usual microphone transmitter T2, with a battery of 8 to 10 dry cells or storage cells, as convenient. The condenser may be a tin-foil and waxed paper affair, but must stand a 110 D. C. volt test continuously without breaking down. The telephone coil should have its secondary winding replaced by one of No. 28 or 30 B. & S. insulated magnet wire, to give it greater current strength.

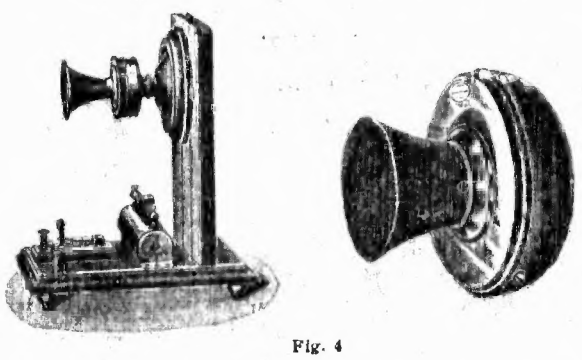
Fig. 4

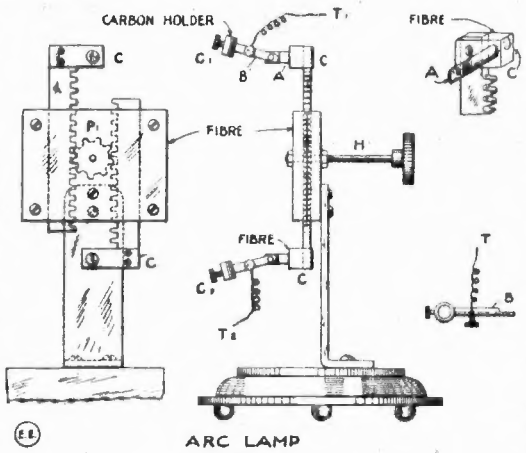

FIG. 2

The inductance of the choke coil, the rheostat resistance and the arc length, all have to be adjusted in any case, until the best results are obtained. A hood with a smoked glass window in it should be placed over the arc light, as it is very injurious to the eyes.

The arc lamp itself should be a hand adjusted type, such as used in stereopticans, etc., and the ingenious experimenter can easily build a satisfactory one after the drawing given at Fig. 2. Two pieces of gear rack, and a small intermeshing pinion p1, firmly mounted on the end of an arc adjusting rod and handle H, make up the moving parts proper. Two fibre blocks C C, serve to insulate the carbon holders C1 and C2, from the racks, which would otherwise give rise to a short-circuit of course, thru the instrument. No. 12 or 14 B. & S. rubber covered copper wire should be used for connecting up the various apparata in this outfit. The arc lamp may be mounted on a wood or slate base as

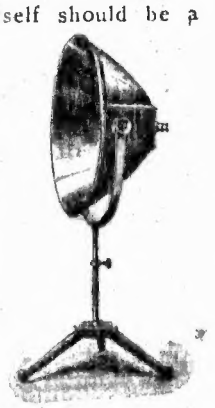
Fig. 5

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outlined in the sketches, which make the matter quite clear without further comment.

The photophone or *Light Telephone* system worked out by Alexander G. Bell, utilizes a speaking arc light, such as herein described, and the general arrangement the photophone which transmits the spoken word along a beam of radiant light, is seen at Fig. 5. As perceived, the speaking arc itself is placed at the focus point of a parabolic reflector, see Fig. 6 for general style of same; and at the receiving station, a selenium cell (such as Electro $5.00 type) is placed in the focus of a second parabolic reflector. The amateur may easily fashion a couple of fair-sized reflectors out of bright tin, forming them into approximate parabolas by a wood or other template, laid out on a parabolic curve as explained in any geometry or drawing textbook. A selenium cell changes its electrical resistance with a varying strength of light thrown on it, and so it is at once seen how the fluctuating light rays given out by the speaking arc are transmitted thru space to the second or receiving reflector. Here the changing resistance values of the selenium cells manifest themselves in an ordinary 75 ohm telephone receiver, connected up with 10 to 15 dry cells as diagrammed at Fig. 5.

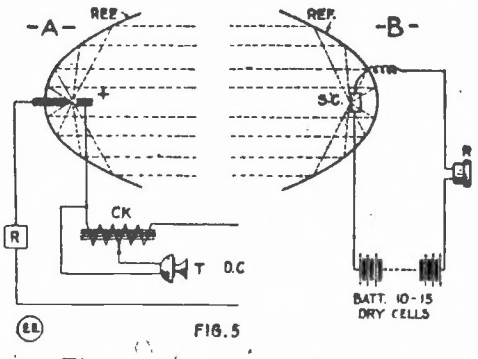


FIG. 5

The selenium cell supplied by the E. I. Co., is illustrated by Fig. 7, and these serve for the purposes of a phototone very nicely. They come in various resistances and light and dark resistance ratios. Some cells have a resistance in the dark of 4,000 to 5,000 ohms, and drop to anywhere from 1/2 to 1/5 of this value in a bright light. The following data on the wonderful metallic substance selenium, chemical symbol Se, will undoubtedly be of interest to our readers, as very little is available on the subject among text-books.

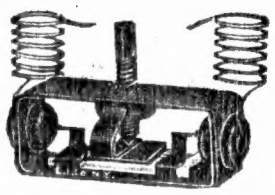


Fig. 7.

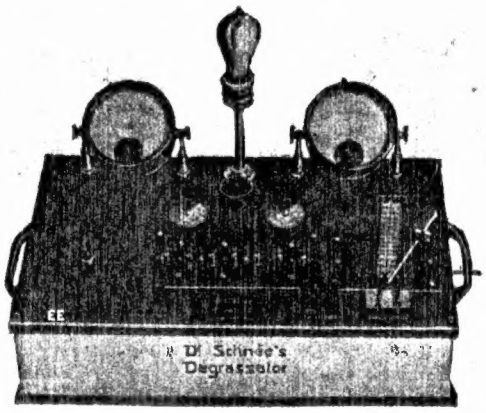
In 1875 Willoughby Smith discovered that the metal selenium (an element), possessed the abnormal property of changing its electrical resistance under the influence of light. Ordinary fused or vitreous selenium is a very bad conductor; its resistance being nearly forty-thousand-million (3.8×10^{13}) times as great as that of copper. When carefully annealed, (by keeping it for some hours at a temperature of about 220° C., just below its fusing point, and subsequent slow cooling); it assumes a crystal-like condition, in which its electrical resistance is considerably reduced. In the latter condition, especially, it is sensitive to light. Prof. W. G. Adams found that greenish-yellow rays were the most effective. He also showed that the change of electric resistance varies directly as the square root of the illumination, and that the resistance is less with a high electromotive-force than a low one. Later, Prof. A. G. Bell and Mr. Sumner Tainter devised forms of "selenium cells," in which the selenium is formed into narrow strips between the edges of broad conducting plates of brass, etc., thus securing both a reduction of the transverse resistance, and a large amount of surface-exposure to light. Thus a cell, whose resistance in the dark was 300 ohms, when exposed to sun-light had a resistance of but 150 ohms. This property of selenium, the later experimenters have applied in the construction of the Photophone, an instrument which transmits sounds to a distance by means of a beam of light reflected to a distant spot from a thin mirror thrown into vibrations by the voice; the beams falling, consequently, with varying intensity upon a receiver of selenium connected in circuit with a small battery and a Bell telephone, in which the sounds are reproduced by the variations of the current. The speaking arc is the modern method employed, and considerably developed by Ruhmer, the German engineer.

Similar properties are possessed, to a smaller degree, by tellurium and antimony. Carbon is also sensitive to light.

About the middle of the present century, Becquerel showed that when two plates of silver, coated with freshly deposited chloride of silver, are placed in a cell with water and connected with a galvanometer, a current is observed to pass, when light falls upon one of the two plates; the exposed plate acting as a negative pole.

THE REDUCTION OF OBESITY BY ELECTRICAL MEANS.

Experiments in the treatment of obesity by means of electro-therapeutic applications date back a good many years. In 1897 Dr. E. C. Schnee recommended the application of faradic currents in the four-cell bath. Later on, Professor Bergoine applied successfully continuous faradic currents in order to bring about contraction of the muscles, and Dr. Nagelschmidt used the Leduc current for the same purpose. This kind of current has the advantage of being less painful owing to its anaesthetic effect.

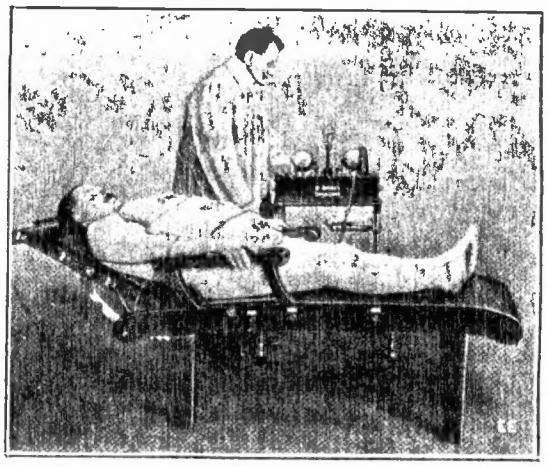


The Control Apparatus.

The *condenser discharges* as applied by Dr. Schnee's "Degrassator" have the same anaesthetic effect and at the same time have the great advantage of causing far more *energetic contractions of the muscles*. The objection which has been raised to the condenser discharges that owing to their suddenness and abruptness they produce a disagreeable sensation, holds good only in the case of single discharges of small capacities. Discharges of greater capacities when they follow each other in rhythmical intervals of, say, the frequency of the average pulse rate, produce a slight, rather agreeable sensation in the contracting muscle; when the treatment is continued a calming, sedative effect is the result.

The "Degrassator" Obesity Apparatus, built on the principles of Dr. Schnee, consists of a switch table and a couch. The switch table contains a voltmeter, a milliammeter reading up to 5 MA., with shunt up to 50 MA., two rheostats for regulating the voltage, and three capacities of 5, 10 and 20 microfarads. By their combined capacities, 5, 10, 15, 20, 25, 30 and 35 MF. may be applied. There are, in addition, switches for single or automatic rhythmical discharges, the number of the latter being adjustable by means of a metronome within 40 to 230 impulses per minute. The automatic impulses can be made direct or alternating. There is also mounted on the table the main switch, a current reverser and an incandescent lamp connected in series with the terminals.

To the *couch* 4 large metal electrodes are adapted, 2 for the back and 2 for the seat. These electrodes may be easily detached and disinfected. On the sides of the couch are plugs for attachment of cables with flexible electrodes, to be applied to the upper-arm, fore-arm, upper thigh, leg, breast, and abdomen. There are altogether 15 electrodes, including an indifferent one. Each electrode may be connected either to the positive or negative pole by means of 15 small switches mounted at the top part of the couch. In some cases a heavy roller-electrode, weighing 11 lbs., may be used to advantage. It serves for labile electrisation.


The patient is placed on a couch and loaded with weights, which often weigh over 200 lbs.

(Continued on page 40.)

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Experimental Electricity Course

By S. Gernsback and H. Winfield Secor

LESSON 12.
INDUCTION COILS AND GEISSLER TUBES.

THERE are two general classes of spark coils, one having a single coil winding and utilized mostly for gas lighting, the other composed of two windings, known as the primary and secondary, and used to produce a jump spark, for wireless purposes, gas engine ignition, X-Rays, etc.

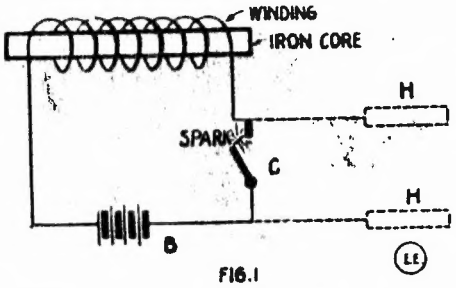


FIG. 1

The single winding type of coil produces a fat spark at the point where its circuit is broken, which is of momentary duration. It is due to the *"self induction"* of the coil, and is the result of the following action. Referring to Fig. 1, the circuit of a wipe spark coil, with battery B, and make and break contact C, is plainly shown. When the contact is closed, the battery current flows around the coil, having the soft iron wire core within it, and strongly magnetizes the core. At the instant the contact breaks the circuit, the magnetism in the iron core collapses or dies down very quickly, and this rapid change in the value of the magnetic flux, causes a current of great instantaneous value to be generated in the coil or winding, and this is the current creating the bright spark seen on quickly opening such a circuit. It has great calorific or igniting value, and is much employed for lighting gas jets, exploding gas engine mixtures, etc. If two metal handles or electrodes are attached to either side of the break contact, as indicated by the dotted lines, in Fig. 1, a shock will be felt, whenever the circuit is broken. The self-induced break current, is often termed a "kick current," in electrical parlance and the coil is referred to as a "kick coil" or "inductance coil."

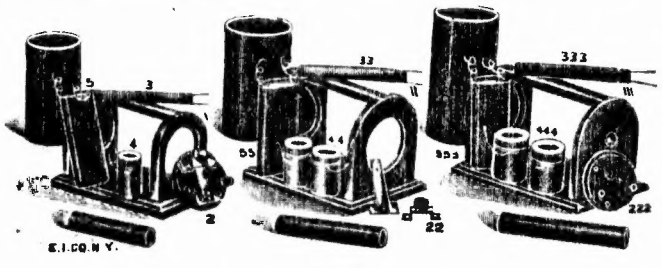


Fig. 2

In Fig. 2, is illustrated the component parts going to make up a coil of the "induction or jump spark" class, having both primary and secondary windings, together with a spring vibrator or interrupter, for making and breaking the primary current. The connection of the various sections with the battery is seen at Fig. 3. Here P P, is the primary coil terminals, and S S, the secondary coil terminals connecting to the spark gap S G. The vibrating interrupter is at V, H being the contact spring and iron hammer attracted by the core of the coil; C is the contact screw and pillar; K is a paper and tinfoil condenser shunted across the vibrator to absorb the extra or self-induced current at break of the primary circuit, so as to cut down the sparking at the contact points, and also to assist in quickly demagnetizing the core, which greatly enhances the effect on the secondary winding; as the quicker the core is demagnitized, the more pronounced the effect on the secondary coil. The vibrator spring is attracted to the core, but in so doing it breaks the circuit, and hence immediately flies back against the contact screw, completing the circuit again, much the same as in the ordinary electric bell. This keeps up as long as the current is supplied to the primary coil.

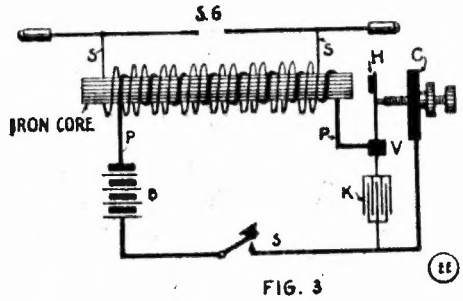
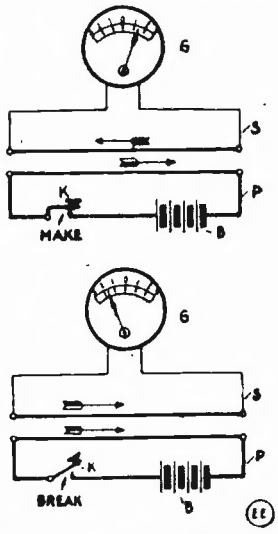


FIG. 3

The physical action of the induction coil is primarily due to the fact that a current passing momentarily in the primary coil, creates about itself, a magnetic field of force, which, when another coil of wire is placed within it, with its axis parallel to that of the primary coil induces in this coil a secondary current, as it is termed. The voltage of this secondary or induced current is proportional to the number of turns of wire it contains, in comparison to the number of turns in the primary winding. Thus, if the primary coil contains 100 turns of wire, and the secondary 50,000 turns, then if 10 volts passes through the primary, the secondary coil will have 50,000 divided by 100 or 500 times 10 volts, or 5000 volts induced in it. This is sufficient voltage to leap a gap in ordinary air, one-quarter of an inch long.



Figs. 4 and 5

The action of the coil at make and break of the primary current is perhaps best explained by the diagrams shown in Figs. 4 and 5. As seen from Fig. 4, the direction of the induced current in the secondary coil, S, *is opposite* to the direction of the primary current *at make*. The half wave of the secondary current induced at the *make* of the primary circuit, is not of a very high value, and is known as the "inverse current." It is very undesirable in operating X-Ray tubes, tending to blacken the tubes. In medical or faradic induction coils, it is always present, but even tho of a weak character, the secondary current of these coils are often referred to as positive or negative currents. In fact, pole test paper will show a predominating polarity. The polarity of the secondary current is readily reversed by simply reversing the primary current. The relation of the inverse or make current of the secondary is graphically shown at Fig. 6B. The strongest half wave, that resulting from breaking the primary circuit is in the same direction as the primary magnetizing current, as shown by the cut Fig. 5. The potential value of the secondary half wave resultant from breaking the primary circuit is seen at Fig. 6, A. The space of time when no current passes in the secondary, C, is during the interval when the contact of the vibrator is open. The curves shown at Fig. 6, are more typical of a medical coil current, the spark coil current wave form being more peaked, like that in Fig. 7, owing to the quickness of breaking the primary circuit, which is here aided by the condenser shunted across the vibrator. Here A, A, are the suddenly induced secondary half waves of a spark coil at break of primary circuit; and B, B, are induced half waves produced at make of primary circuit. The dotted lines show the primary cur-

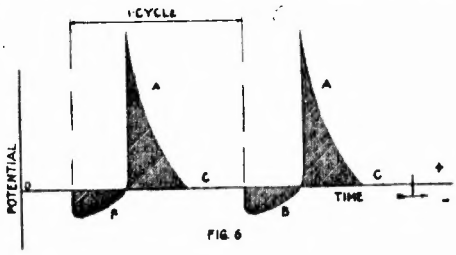


FIG. 6

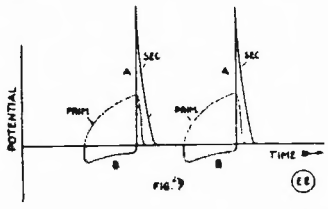


FIG. 7

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rent. In most cases, when the spark gap is of any appreciable length, the "break induced" half waves, which may be either positive of negative, according to the polarity of the primary current, are the ones leaping the gap; the weaker "B" half waves of inverse current, not being able to leap the gap. In such an event, the spark takes on a certain polarity, as will be evident; but if the gap is short, and both "A" and "B" half waves succeed in leaping it, then the spark is formed of an unsymetrical, pulsating, alternating current. A regular sinusoidial alternating current is one whose both half waves, positive and negative, are equal or nearly so, in magnitude and duration.

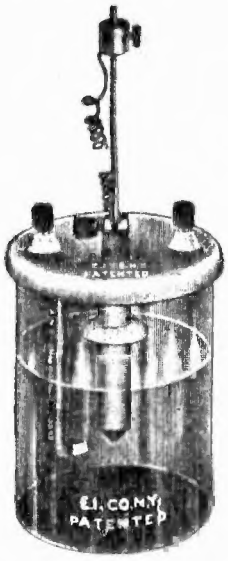


Fig. 8

The polarity of spark coil discharges can be ascertained by attaching two fine iron wires to the secondary terminals. The wire remaining cold is the positive one, while the one becoming hot is the negative pole.

For operating spark coils at maximum efficiency or voltages over fifty, alternating or direct current, the Gernsback Electrolytic Interrupter is a very useful instrument. It consists of a special metal rod resting in a porcelain tube, having a slight orifice or opening at the bottom. The tube and rod are immersed in an electrolyte or acid solution, and when connected into the primary circuit, it interrupts the current at enormous speed, the rate of make and break sometimes reaching several thousand a second. It is very simple in operation, also inexpensive as to first cost and maintenance. Its appearance is seen at Fig. 8. For 110 volts or 220 volt circuits, a choke coil consisting of a bundle of iron wire, wound with several layers of heavy copper magnet wire, is best connected into circuit to prevent an excessive current flowing and blinking the lights. The manner of hooking up the choke coil is shown at Fig. 9. The spark resulting from the use of the electrolytic interrupter, is seen at Fig. 9A.

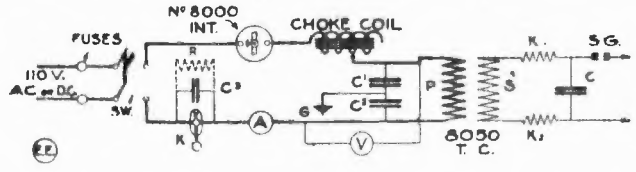


Fig. 9

Spark coils of the induction type are also widely used for gas and gasoline engine ignition. A diagram for connecting up at ½" spark coil to a single cylinder gasoline engine is shown at Fig. 10.

A standard form of spark coil is depicted at Cut 11. This is the "Bull-Dog" Coil produced by the Electro Importing Co., of N. Y. City, and is built in all sizes from ¼" spark up to 12" spark capacity.

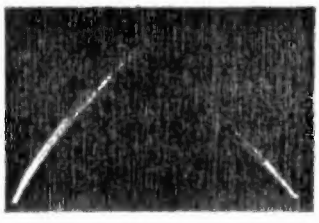
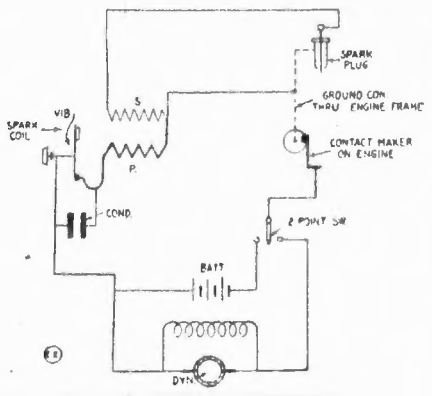


Fig. 9A

The field of experiment with spark coils is endless, and some of the more interesting and instructive examples are cited below, but it is hoped that these will but serve to lead the way to more elaborate and extensive experiments. It may be said that the bigger the coil, the more elaborate and spectacular the experiments.



A common, yet extremely interesting experiment with any spark coil is the spark ladder. Two thin iron wires are bent as shown at Fig. 12. By a little experiment, the proper shape of the wires will be found, when the spark will run up the ladder, stop, begin at the bottom, etc., repeating the performance indefinitely. The heated air caused by the passage of the spark, is the reason for the spark tending to rise. Heated air is a better conductor than ordinary air.

A very pretty experiment with spark coils, is that created by strewing carbon or other filings upon a glass plate. The secondary wires are connected to opposite ends of the body of filings. The spark divides up and takes devious paths thru the filings, forming a very striking experiment.

A spark-board is easily made and amply rewards the builder, as it is extremely pretty in the dark, resembling a million sparkling diamonds. At Fig. 13 A, is shown how to make a regular spark board.

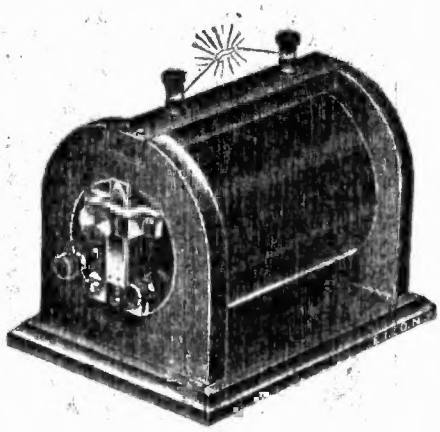


Fig. 11

This is nothing but a piece of dry wood well shellacked, and coated on the front face with tinfoil. Diagonal cuts with a sharp knife are then made in both directions as shown dividing up the surface into a large number of small spark gaps. Using different kinds of metal foil, such as copper, aluminum, etc., gives different colored sparks. At Fig. 13 B, is shown how to construct a spark word-board. The letters are formed of a narrow strip of tinfoil leading continually forward toward the other end of the board. The foil may be about ⅛" wide. After gluing it fast, a sharp knife is used to produce minute spark gaps, about ⅛" to ¼" apart. At opposite ends of the word or letters, are attached the terminals of the spark coil secondary.

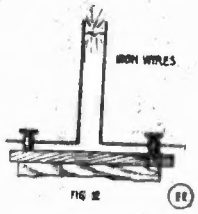


FIG 12

The length of spark given by a certain coil is always understood to mean when measured between needle points. When metal spheres are used as electrodes, the spark cannot leap such long gaps, as between needle points; for the reason that the spheres present a greater capacity, and part of the energy is utilized in charging them. A striking form of discharge is formed between one ball and a pointed electrode; with the ball positive the spark is very different from that when the ball is negative.

When a piece of glass or mica is placed between the electrodes, the spark tends to branch out and strike around the edge of the sheet. If not too thick, the sheet will be punctured, as the voltage of the spark is very high, being about 20,000 volts for 1 inch spark between needle points.* (Root means square value; the maximum value per 1" induction coil spark is about 50,000 volts.)

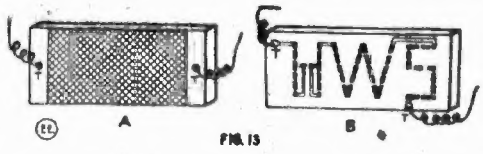


FIG 13

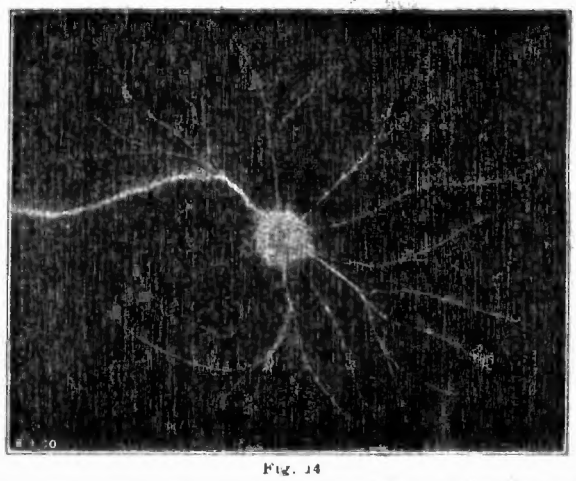


Fig. 14

The spark coil presents a good means of getting rid of cats, or dogs, which prowl around the yard, or for giving a nice surprise to chicken thieves. One terminal of the second-

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ary in this case, may be grounded or connected to a piece of sheet metal. The other terminal is carefully insulated and led to the object with which the subject is to come in contact.

Photographs of electrical spark discharges are very beautiful and instructive. A cut of a discharge is shown at Fig. 14. Ordinary photograph plates are used, the exposure

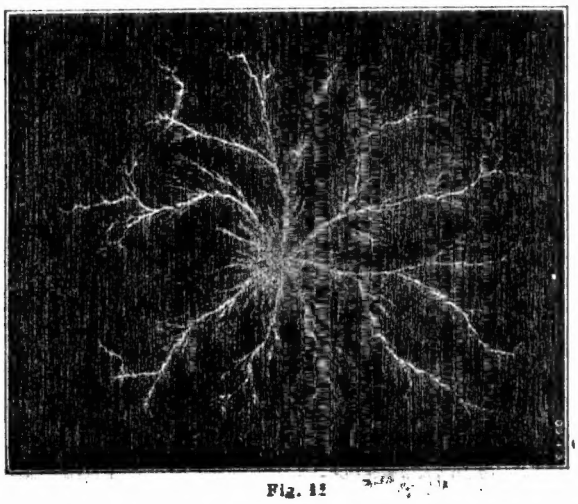

Fig. 14

being made in the dark. Take a small wide mouth bottle, and fill it half full with dry pine starch powder or talcum powder. Over the mouth of the bottle fasten a piece of fine gauze, to serve as a sieve. Tie the gauze around the neck of the bottle with a string. Then take the photograph plate, and with the emulsion or coated side up, place it upon a piece of sheet iron, tin, etc. Connect the metal plate with one of the secondary terminals of the coil. A thin layer of the powder from the bottle is now sifted over the photographic plate. A fine metal point such as a pin, is set in the middle of the powder prepared surface. The pin point is connected to the other secondary post of the coil. Close and open the coil primary circuit quickly, making one spark. After making the spark, the plate is wiped off to clear it of powder and developed in the regular way. Changing the polarity of the metal point will give different results. Fig. 14, is the result of connecting the negative pole to the point, while Fig. 15, shows the photograph resultant from connecting the positive pole to the point. Patterns, as of a star, your initials, etc., can be cut out of paper, and placed over the plate, before sifting the powder on. When the spark is made and the plate developed, the design will have the shape of the outline used.

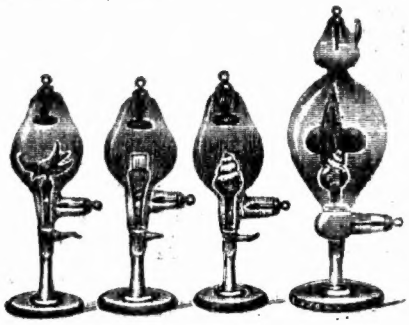

Fig 16

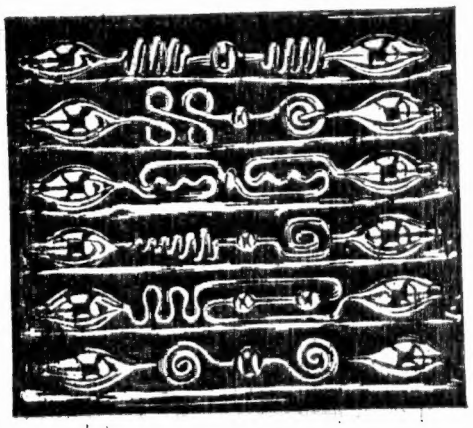

Fig. 17

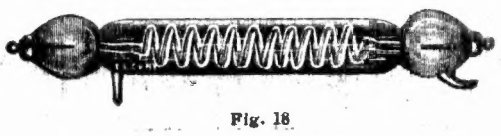

Fig. 18

The most beautiful displays from the high potential discharges of the induction coil are given off by exhausted glass tubes, generally called *"geissler"* tubes. The simplest tube is an incandescent lamp bulb. If connected to one pole of the spark coil, it will glow with a very weird, bluish light. It will glow quite strongly if simply brought into proximity to the coil; without any connection between it and the coil.

Geissler or exhausted tubes are made in a variety of forms and styles, some upright tubes having pedestals formed upon them, and containing various minerals, etc., are illustrated at Fig. 16. These tubes are extraordinarily beautiful in the dark, glowing with vari-colored hues. Some odd shaped tubes capable of giving off different colors are depicted at Fig. 17. These are highly exhausted vacuum tubes. One of the finest tubes made is that seen at Fig. 18, which is a tube containing certain liquid mixtures, resulting in an indescribable display of color, when excited.

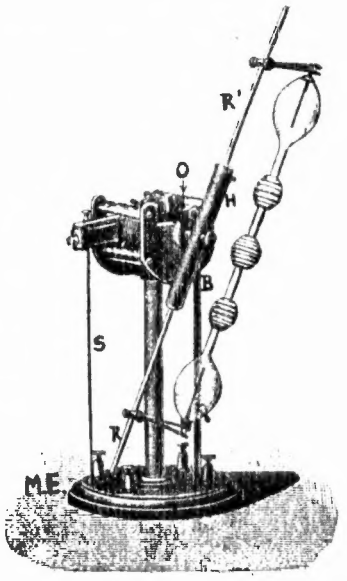

Fig. 19

Very little energy is consumed in lighting geissler tubes, and a one inch spark coil will illuminate 12 to 18 tubes at once, depending upon their size. The average size is 8 or 10 inches long. Geissler tubes have been made to form a name, the tube being a continuous evacuated chamber, with metal terminals sealed in both ends. It may be said here, that the metal lead-wire passing thru the glass, must be platinum, as this has the nearest expansion and contraction coefficient to glass.

The finest and most entrancing displays for lectures or experimental study are obtained from revolving Geissler tubes. A small battery motor such as E. I. Co., type S, serves the purpose admirably well.

A motor attachment for rotating Geissler tubes is seen at Fig. 19. Here H is a fibre or hard rubber sleeve, serving to insulate the rods R R, supporting the Geissler tube. A double contact drum and brushes are fitted to conduct the coil current to the tube as it revolves.

(To be continued in next issue.)

NEW FRENCH WIRELESS TESTED.

The automatic wireless apparatus invented by the French engineers Ducretet and Roger is being experimented upon from the Eiffel Tower Radio Station. The machine receives messages sent by the Morse code, registering them automatically on tape.

The experiment has proved a success so far as tested, which is up to 500 kilometers. Such an apparatus would, it is said, add materially to the safety of ships at sea.

INSTITUTE OF RADIO ENGINEERS.

At a meeting of the Institute of Radio Engineers held at the Engineering Societies Building, New York, June 3, Mr. Melville Eastham, of Boston, presented an interesting paper on the methods of radio transmission involving high group frequency and sending apparatus. He described a number of types of equipment using rotary, quenching spark-gaps, and operating on both direct and alternating current. In this method as ordinarily used a low-frequency alternating current or a direct current is employed to produce sparks recurring at a rate above the upper limit of audibility, and the very rapid groups of electromagnetic waves thus created are further subdivided into trains at audible frequencies. In this way it is said to be possible to secure higher over-all efficiency than by the common methods of conversion involving motor-generators.

Mr. Eastham also described methods of measurements involving high-frequency wattmeters operating on the dynamometer principle and gave a number of results secured by their use.

The paper was discussed at length by Messrs. Etone, Mayer, Pichon, Marriott, Simon, Hill and Hogan.

Edw. J. Donnelly, of Paterson, N. J., a satisfied E. I. Co. customer, writes:—"Am using your 6-60 Battery No. 555 to light a traveling butcher wagon; and it gives fine service."

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THE CONSTRUCTOR

AN EFFICIENT BATTERY FAN.

A SIMPLE and efficient battery fan motor may be made up from a couple of E. I. Co., 5" or 6" steel horse-shoe magnets, as indicated in our sketches presented herewith. At Fig. 1 is shown the assembled fan motor and at Figs. 2 and 3, the details of the various parts, making up the armature and brush rig, etc.

A wood base frame and cross-strip serve to clamp the two steel magnets in an upright vertical position as seen at Fig. 1. Two iron pole pieces P1 and P2, Fig. 2, with iron yokes strips y, y, of 3/16" x ½" wrought iron, surround a small "H" type armature, detailed at Fig. 3. The pole shoes P1 and P2, are readily made from a piece of 1¼" inside diameter wrought iron pipe, 9/16" long. These are secured to the 2 yoke pieces

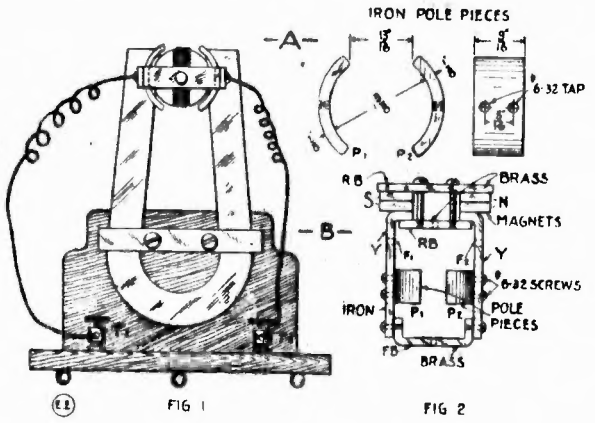

FIG 1 FIG 2

by No. 6-32 machine screws threaded into same as shown. The yokes are secured to the ends of the steel magnets by clamping as indicated. Two brass bars RB, RB, with 2 brass machine screws threaded into the inner one, do this clamping satisfactorily. A brass front bearing strip FB, is mounted between the yokes as shown. The inside clamb RB, has a hole drilled thru its centre for the rear bearing of the armature. The two North poles of the steel magnets must be placed together of course, which is easily tested out by means of a compass as supplied by the E. I. Co., or by the rule, *that unlike magnet poles attract, while like poles repel.* Two copper or phosphor-bronze strip brushes about ⅛" wide are mounted on the rear of the yoke strips, by drilling 2 holes thru them, at b1, b2, and one brush at least must be insulated from the iron frame by fibre washers and a sleeve placed about a small machine screw and nut, serving to clamp the brush to the frame. The two brushes touch on top and bottom of the commutator, as seen at Fig. 3.

Referring further to Fig. 3, the details of the armature are observed. The commutator is made from a piece of brass tubing about ⅜" or ½" diameter and ½" long split into 2 equal halves, and secured on a wood or fibre core by a fibre ring placed over the 2 segments at one end. The armature

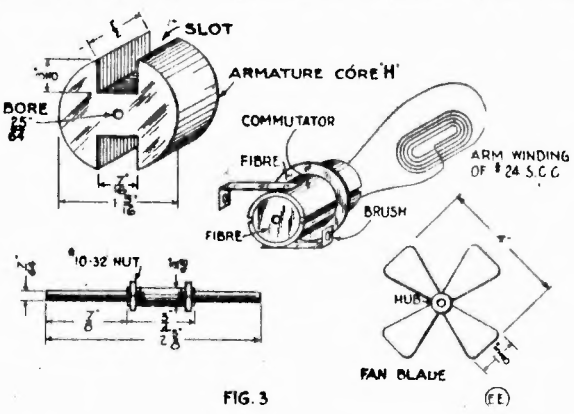

FIG. 3

winding terminals are soldered to the segments. The shaft of steel, iron or brass is detailed at Fig. 3, and needs no special description. The armature laminations, forming the core "H," are locked between two No. 10-32 nuts threaded on the shaft. The commutator core is drilled out to make a driving fit on the shaft.

The armature core "H," is made about ½" long of sheet iron discs which may be easily cut out by a pair of scissors or tinners snips, to the size shown in the sketch.

After the core has been made up and assembled on the shaft, any burrs or rough fins on same should be filed off. It may then be insulated by a layer of paper shellacked over the inside slot surfaces where the wire is to touch, including the armature ends, and shaft.

The slot is then wound full with No. 24 or 26 S. C. C. magnet wire, depending upon the voltage it is to work on, dividing up the turns in each layer on either side of the shaft. The No. 24 wire may be used for battery current of 4-6 volts, and No. 26 wire for currents up to 10 or 15 volts. Finer wire may be used for higher voltages.

A simple fan is fashioned out of aluminum or brass, and mounted on a hub fitting the shaft, as seen at Fig. 3. A small set screw should be tapped into this hub, or it may be made a driving fit on the shaft. This fan may be operated from dry, storage or Gordon primary cells. Dry cells give 1.5 volts each; storage about 2 volts each; and Gordon cells .7 volts each on closed circuit or doing work. A sufficient number of cells should be used to give the desired voltage. A No. 5000 Rheostat-Regulator serves nicely as a speed regulator for this fan motor and it is simply connected in series with the motor circuit. About ¼ lb of magnet wire will be required.

OLGA'S SURPRISE PARTY.

By Thos. N. Benson

"WHAT'S troubling you now, Jim?" asked Paul Maines, as he stepped into the Wizard's laboratory and found him deep in thought over a sheet of paper covered with drawing and diagrams.

"Doping out a new kind of surprise party for Olga's benefit. Next Monday is her birthday, you know, and I'll have to put over something new," replied the Wiz.

"Let me in on this, will you?" begged Paul. "I want to get wise to a few things so I can work something off over at our house shortly."

"All right, we'll make a list of apparatus; get it together,

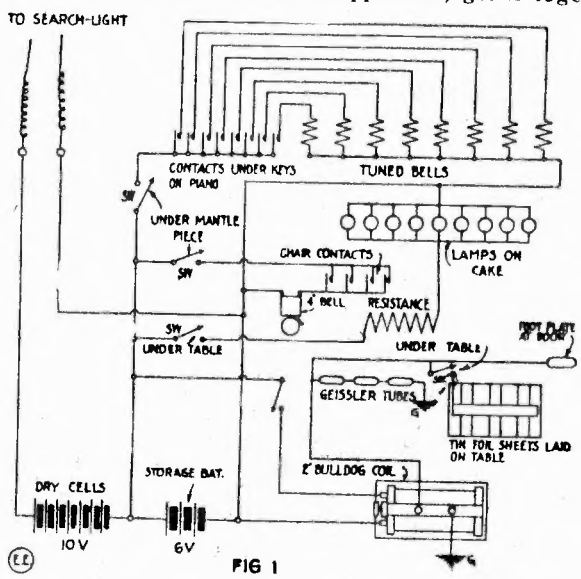

FIG 1

and you help me to put it up Sunday, when she is away," and they both set to work immediately.

What was the result?

"Well, Monday evening, when the time for the party came around, all was in readiness. The Wiz. had invited five couples *via wireless,* and explained everything to them in detail. They, according to instructions, had gathered at Paul's home a few blocks away, awaiting the signal to start. They had several baskets of lunch, cakes, and other goodies with them.

After supper Olga went up-stairs to dress preparatory to visiting the "movies," her pet hobby. Her bedroom door was hardly closed, before the Wiz. was *"Jamming the ether"* informing the others to hurry over. Olga heard the crashing of his spark, but being unable to read *Morse,* it meant nothing to her.

The Wiz. was at the door to welcome his guests, and like

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so many shadows they followed him into the parlor. They arranged themselves in a semi-circle round the door-way. The Wiz. then called to Olga and, drawing a long tube from his pocket, connected it to two wires laying coiled up in a dark corner, and stood opposite the door waiting for her to appear.

Steps sounding on the stairs set them all a-tingle and as she appeared in the doorway, a brilliant beam of light brought out every detail. She sprang back with a shriek, but too late; the guests were showering confetti and good wishes on her with lavish hands.

The lights were turned up, and congratulations were followed by gifts and much joking and laughter went around the circle of jolly revellers.

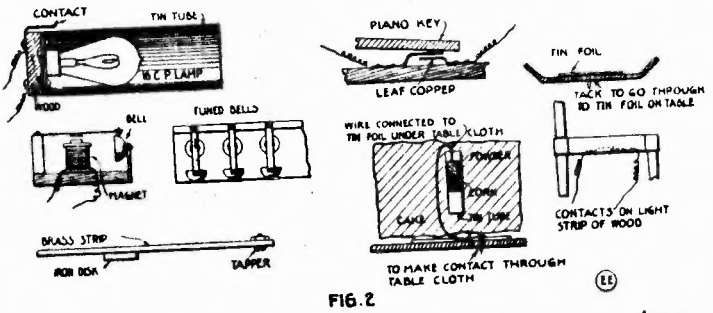

FIG. 2

Olga seated herself at the piano and an impromptu dance was in order. A close observer would have seen Paul, on a signal from the Wiz. put his hand under the mantel-piece, and as the playing continued, unseen bells accompanied her, causing unbounded surprise and delight to the guests.

One couple tired of dancing sat down to rest for a moment on the sofa and were instantly started to their feet by the clang and clatter of a 4" gong. "FIRE!" was the first thought of the crowd; but a glance at the Wiz. laughing, reassured them. A little experimenting soon revealed the fact that every chair in the parlor was fixed up in like manner, and no rest was allowed the company except to sit on the floor.

Meanwhile, in the next room preparations were going on for the feast. Paul had gone out to see to the trick end of the affair. He returned and spoke a few words to the Wiz., who gave the signal to line up for the "feed." The doors were thrown open to the dining room and as they filed in, many were the expressions of delight at the pretty arrangement of the table.

The room was dark except for the glow of Geissler tubes suspended above the table, and the large birthday cake, on which glowed nineteen miniature lights.

They seated themselves and amid light, banter and joking, started to do justice to the goodies before them.

"You can't play any tricks on us now, Jim," dared one of the fair sex, seated next to the Wiz., "for we brought the food ourselves."

"Take care, don't boast," warned Jim, and he almost laughed outright as he closed a switch under the table unseen. A howl immediately came from one and then another of the guests, and but few escaped a shock. The curious part of it was that it came so unexpectedly. Tempted by an appetizing piece of cake, they would reach for it, only to be nearly knocked off their chair by a nerve tingling shock. Another would *get his* by merely laying his hand on the table cloth.

They would all laugh at the antics of some victim, only in turn to be shocked themselves. Tiring of this, the Wiz. opened the switch and bade them to go on with the repast.

There was no more torture till Olga arose to cut the big cake. As she sunk the knife into the cake a smile was playing around the Wizard's mouth, only to burst into a laugh, when she jumped back with a scream and the rest were bewildered by a flash from the cake.

"Only a little flashlight powder, Sis; go on and cut it," directed the Wiz.

"No, I won't. I got an awful shock that time and I think it real mean of you, Jim," replied the victim.

Jim then cut the cake and distributed it in a jiffy and everybody was pacified and quiet again in short order.

The party then returned to the parlor and the dancing went on till 12 o'clock to the tinkling of bells and the laughter of the happy crowd.

As they bid Olga good-night and shook the Wizard's hand, they received another shock that nearly sent them reeling, but it didn't seem to bother the Wiz. a bit.

"That was some party O. M.," confided Paul to the Wiz. as he left, "and I think they all enjoyed it."

"Oh, yes, but wait till she gets me alone and explains how much she appreciated being scared about half to death," retorted the Wiz.

HOW IT WAS DONE.

Sequel to "Olga's Birthday Party."

"Say Wiz., that party cost you a lot of *kush*, didn't it?" asked Paul.

"Well, let's see. I bought nearly all the stuff from the E. I. Co., and so got full value for the money. I had the storage cells, you know, and the large gong. You can have the complete drawings if you want them," and the Wiz. handed Paul several sheets of paper on which were drawings resembling those reproduced at Fig. 1 and 2.

"Say, that tinfoil laid under the table cloth certainly did get them, all right, all right!" laughed Paul.

"I think they enjoyed the tuned bell stunt, even if it was *some job to make them,*" replied the Wiz.

"Well, so long, Wizard, I'll ether you at the usual time," said Paul, as he left the laboratory, a much wiser human than he who entered it a few brief hours before.

(Finis)

THE REDUCTION OF OBESITY BY ELECTRICAL MEANS.

(Continued from page 35.)

On the electrode to be applied to the abdomen, and those to the arms and legs, sand bags are placed, varying in weight from 10 to 20 lbs. One may start with 10 lbs. and increase the total weight to 100 or 200 lbs. The duration of each application may vary from ten minutes (at the beginning of the treatment) to 60 minutes. In many cases two applications per day can be made. The treatment may be continued for 3 to 8 weeks, and may be repeated after a pause of from 2 to 3 months. The voltage may vary from 20 to 60, the number of milliamps: from 2 to 15.

The anaesthetic effect of the condenser discharges permits the *most efficient contraction of all the muscles of the body.* The patient getting accustomed very quickly to the treatment experiences no disagreeable sensation; the contractions being involuntary *no fatigue* is caused, notwithstanding the fact that the lifting of sand bags totalling 100 to 200 lbs. is quite a considerable work.

The irritation of the vaso-dilators produces dilatation of the peripheral blood vessels, hyperaemia of the skin, perspiration and increase of temperature. The respiration becomes more frequent and at the same time deeper, whereby more oxygen is utilized and more carbon-dioxide produced.

The pulse becomes more frequent but not quite as frequent than would be the case, if the same amount of work were done with Gartner's Ergostat. By increasing pulse amplitudes and sharper dicrotism it may be proved that the resistance in the vascular system decreases and a systolic increase of the blood carried takes place. In many cases also a marked increase of the systolic and diastolic blood pressure will be noticed to take place slowly.

All these phenomena disappear very quickly after the application. The patient never complains about fatigue. He, on the contrary, feels fresher and more disposed to voluntary physical exercise.

The decrease in weight is most remarkable, amounting to as much as one pound per day and, if the dietetic regime is altered, to even more than two pounds. There is no danger of weakening the heart's action as with other methods of treating obesity; on the contrary, *the heart becomes stronger,* and Dr. Schnee's "Degrassator" may therefore be called an ideal apparatus for the treatment of obesity.

In addition, this apparatus may be recommended for *treating muscular weakness and atrophies, weakness of the muscles of the heart, chronic constipation, diabetes, mellitus, etc.*

HAVE YOU AN IDEA?

Are you using a new device or an improved modification of such, in your wireless or electrical laboratory? If so, why not write it up and send to us with a photo or sketch? Drawings invariably have to be made over by our draughtsman, and just so you express your ideas concretely and as briefly as possible we are always glad to publish them, when the article possesses merit. Look over this issue carefully, read the articles twice, and you will soon pick up the knack of writing articles, and moreover we pay you well for your efforts. Why not get busy to-day and get in the swim? Be a live, wide-awake Electrical Experimenter! Boost your paper and boost yourself. It's very easy!

The "early bird catches the worm" is an aged yet truthful jingo, so "throw in your switch and increase your radiation"; in other words, help us and help your pocket-book.

Make all sketches on separate sheets of paper, and write only on one side of your text sheets. Send all contributions to "Editor," The Electrical Experimenter, 233 Fulton St., New York City.

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WIRELESS DEPARTMENT

RADIO-TRANSMISSION AND WEATHER.*

By A. H. Taylor

In a previous Paper on this subject† the writer submitted evidence which seemed to show that unusually good radio-transmission across long overland distances at night is preceded the day before by generally cloudy conditions prevailing in the region across which the nocturnal good transmission takes place. The evidence presented in that Paper has been greatly strengthened by subsequent observations. In particular it may be mentioned that out of some 60 cases of good transmission studied since September 24, 1913, 44 have followed a generally cloudy condition over the area in case, while of the other 16, a majority have accurred during the shortest days of the year, when the hours of sunlight in the latitude of Grand Forks, N. D., are relatively few. Before discussing the bearing of this evidence on the idea of the reflection and refraction‡ of electric waves by ionised layers of the earth's atmosphere, it will perhaps be well to examine some of the data collected at this station since September 24, 1913, for evidence of a somewhat different character.

In commenting upon the previous Paper, the editor of the "Electrical World" suggests that the effects noted might have been indirectly due to general cloudiness, inasmuch as this would usually bring about some rainfall and would therefore probably reduce the ground absorption which is thought to be much larger in overland than oversea transmission. Fortunately the weather during the autumn of 1913, especially during the months of October and November, was of such a nature in this part of the continent as to make it possible to settle this important question. The height of the aerial at this station is but 85 ft., so that the nearest of the Great Lakes stations do not usually make themselves heard until after dark. Nevertheless, during a period of over a month in which no moisture whatever fell in northern Minnesota the stations at Port Arthur, VBA, and Duluth, WDM, were heard as early as 4:30 p. m. on several occasions. Subsequent comparison of weather reports showed that in each instance the intervening region had been very cloudy. In spite of the fact that during this period no rain fell, or even snow until about December 1st, there was a great deal of cloudy weather over northern Minnesota, and hence especially close attention was given to the transmissivity from VBA and WDM. In 80 per cent. of the cases of very good transmission from these stations to this one (9YN) the preceding day had been very cloudy in this region. The effect of moisture on ground absorption is here eliminated. I am, therefore, forced to conclude that the effect of alterations of earth absorption are entirely overshadowed by the larger favorable influence of preceding cloudiness. Incidentally these experiments showed that the normal day absorption on clear days in this region is very large. This is supported by the fact that our own signals sent on a 500-metre wave with 7 amperes aerial current were but fairly received just before dusk in Minneapolis at the North Central High School with a 100 ft. aerial, whereas less than an hour later they were repeatedly picked up by Mr. Keith Russell on a 70 ft. aerial in Toronto. The first distance is 300 and the last 1,000 miles.

It has occurred to the writer to analyse data at hand for the possible influence of barometric pressure on transmission. The weather maps corresponding to the days preceding the evenings of observation were examined and 24 were found which indicated that rather low barometer readings had prevailed in or near the areas across which transmission had been studied. Of these only two were found to correspond with records of bad transmission, while the others all corresponded to records of good transmission. Inasmuch as the weather maps do not arrive here until the day after the transmission records are made, it is not possible for the observer to be prejudiced. For reasons not at once apparent many stations on the Gulf of Mexico or in the Mississippi valley are received here with extraordinary clearness. A great many other stations might be mentioned as being heard here when transmission was unusually good. A good many vessels were reported at this station, but it was not often possible to locate them very definitely. In reference to the influence of barometric pressure, it must be noted that areas of low barometer are always more or less cloudy. In order to settle this point it is necessary to consider the cases where the barometer readings were generally rather high over the areas studied. Of 18 cases which could be put in this class 11 showed good transmission and seven poor. But of these 11 cases of good transmission, four were reported from the valley of the Mississippi, which the author has reason to believe permits phenomenally good transmission, and six were over generally cloudy areas. Of the seven cases of bad transmission associated with rather high barometer, five were over very cloudy areas. The writer does not consider this evidence conclusive, but it might mean that high barometer is unfavorable to transmission. Clear-cut cases for long distances are not easy to find for either the high or the low barometer classes. On the whole it seems as if the presence of clouds is the controlling factor, modified somewhat perhaps by barometric conditions. Bearing this in mind, it seemed worth while to attempt to find out whether cloudiness would be most beneficial at the sender or at the receiver. Accordingly the evenings of observation were divided as follows: (1) Senders and receivers both in cloudy area—Good transmission, 19; bad, 4. (2) Senders and receiver both in clear area—Good transmission, 7; bad, 6. (3) Senders, cloudy; receiver, clear—Good transmission, 14; bad, 3. (4) Senders, clear; receiver, cloudy—Good transmission, 8; bad, 7. From this analysis it seems that few cases of good transmission are reported when both stations have been in the clear area preceding the night of observation and about the same indifferent result is seen when the sender only has been in the clear. On the other hand, when the sender but not the receiver has been in the cloudy, the ratio of good to bad transmissions is about the same as when the cloudiness has been quite general. This ratio is 5: 1 in favor of good transmission. Cloudiness in that portion of the area of transmission near the sender is evidently of the most importance in favoring transmission. This should have an important influence on the formation of any theory which will take account of the variations of nocturnal transmission as a function of the weather of the preceding day.

*Abstract of a Paper in the "Physical Review."
†"Electrical World," August 30, 1913.
‡Dr. W. Eccles, in "The Electrician," Vol. LXIX, p. 1015, September 27, 1912, and Vol. LXXI, p. 969, September 19, 1913.

PROGRESS IN RADIOTELEGRAPHY.

A LARGE part of a paper by Mr. H. Diesselhorst on recent radiotelegraphic progress, read before the annual convention of the Verband Deutscher Elektrotechniker, in Magdeburg, deals with methods for generating continuous oscillations at the sending station. These consist broadly of arc methods, alternator methods and transformer methods. The arc methods aim to set up continuous oscillations in a secondary circuit from pulsating currents in a primary circuit containing the arc. They have the advantage that the electron streams in the arc have immense mobility, or extremely small inertia, and hence are able to respond to impulses of very high frequency. Their difficulties lie in the way of controlling sufficient power for long-distance radiotelegraphy.

The alternator methods include the method of direct high-frequency generation developed by Fessenden and Alexanderson in this country, and also the method of mixed generation and frequency raising developed by Goldschmidt in Europe. These methods have the advantage of definitely impressing continuous forced oscillations on the sending antenna. Their difficulties are found in increasing their power, since enlarging the machines means increasing their mechanical and electrical stresses in rapid proportion. The step-up frequency transformer methods depend upon nursing some harmonic frequency into prominence. This may also be done in conjunction with specially designed freak-harmonic alternators. This is the most recent direction of experimental advance and seems to be very promising. Sooner or later, it is to be hoped that machinery can be built for the generation of hundreds of kilowatts at a frequency near to 100,000 cycles per second.

It is suggested that reflection of waves from a high-level discontinuity layer in the atmosphere may be capable of producing interference phenomena whereby the intensity of received signals may alternately wax and wane as the waves expand. By noting, at a given range, the wave-lengths of maximum and minimum receiving intensity, the height of the reflecting layer may be estimated. In a particular case this height is worked out to be about 100 km. An acoustic analogue to the electrical reflection phenomenon is discussed. Indications are given of an acoustic reflection produced by a discontinuity layer of atmosphere about 70 km. high, and it is stated that the sound-wave due to an explosion of dynamite at the Jungfrau station in the Alps in November, 1908, was found to be reinforced in this way. At least, it has been claimed that the distance at which the explosion was heard could only be accounted for in such a manner.—*Electrical World.*

The Northumberland Wireless Club of Sunbury, Pa., has purchased a new sending outfit. A receiving outfit will be purchased in the near future.

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HOW-TO-MAKE-IT DEPARTMENT

This Department will award the following monthly prizes: FIRST PRIZE $5.00; SECOND PRIZE $2.00; THIRD PRIZE $1.00. The idea of this department is to accomplish new things with old apparatus or old material, and for the most useful, practical, and original idea submitted to the Editors of this department, a monthly series of prizes will be awarded. For the best ideas submitted, a prize of $5.00 will be given; for the second best idea a $2.00 prize, and for the third best a prize of $1.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings.

FIRST PRIZE, $5.00

A Vacation Radio Pocket Set

By Harry V. Johnson

EVERYONE interested in any way in wireless matters undoubtedly would like to have a small compact radio receiving set which could be carried about the same as a Kodak. A description is given herewith for making up such a pocket receiving set, which need cost but a few dollars. E. I. Co., apparatus serves to make this set both compact and efficient.

At Fig. 1, is outlined the general arrangement of the whole set, which includes:

A wood or metal carrying case.
1 No. 1307 or 6667 radio telephone receiver.
1 No. 10010 Jr. Fixed condenser.
1 No. 8487 Loading Inductance.
Parts for detector.
Special Loose-Coupler.

The carrying case may measure about 4¼" x 8½" by 2" high inside, and can be of ¼" wood, varnished and stained or what is more serviceable, to cover the wood with black book

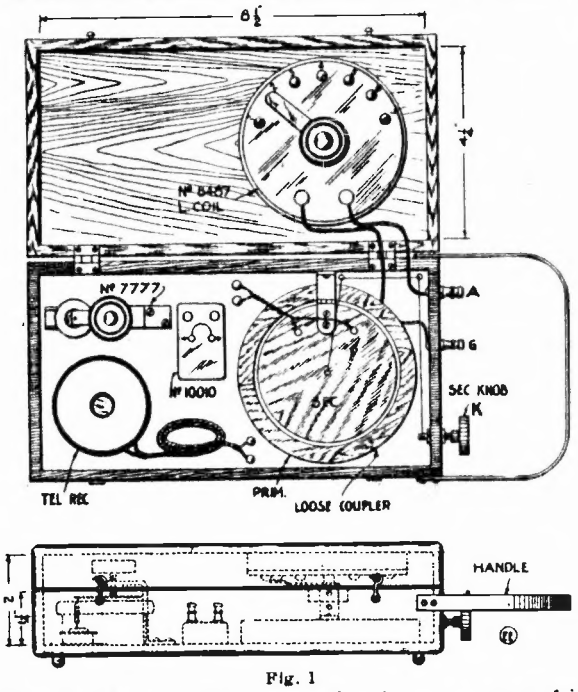

Fig. 1

leather or leatherette. To make a handsome set out of it the inside of the cabinet should be lined with black or blue velvet. Also an outfit made up in this way would make a very attractive gift. A leather handle should be mounted on the case at one end to carry it with, and two hooks as shown or a small lock can be fitted to it. A simple and strong lock design for wireless apparatus cases is indicated at Fig. 3. As seen it consists simply of a metal disc with a slot cut in it. The pin indicated, is fastened on the lid of the case, and when closed down, a quarter turn of the disc locks it securely. The disc may be 1/16 or ⅛" brass, etc. A screw forms the pin on the lid. Two main terminal binding posts are fitted on the end of the case at A and G, for the aerial and ground connections respectively. Also an "Electro" detector knob and screw K, for moving the secondary coil of the coupler up and down.

The special loose coupler, altho a small affair, will be found quite efficient indeed. Its details are perceived at Fig. 2. Both the secondary and primary coil forms are made of some close grained wood, shellacked or varnished. Mahogany or maple is very good. Hard rubber is of course ideal, and the two winding grooves are easily turned in the peripheries or edges of the discs. The primary disc is wound full with No. 22 cotton covered or enameled magnet wire, wound on as roughly as possible, and not evenly. This is to give the effect mentioned regarding radio transformer coil windings in the May, 1914, "Electrical Experimenter."

The secondary coil is made of No. 28 insulated magnet wire and the slot is wound full; staggering the succeeding turns as much as possible, and not laying on the turns in even

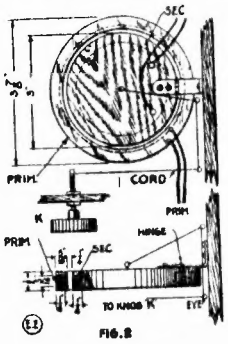

FIG. 2

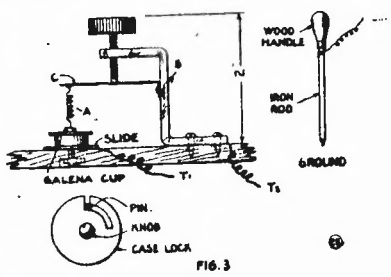

FIG. 3

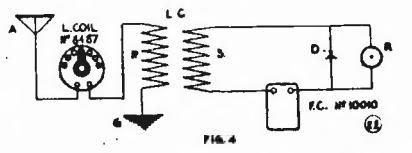

FIG. 4

layers. A piece of duplex or small size double conductor lamp cord, serves to make the connection to the secondary coil.

The secondary coil form swings out of the primary coil on a hinge, similar to Telefunken type loose couplers, and a common brass hinge is readily adapted to this purpose, by soldering 2 pieces of 1/16" brass on either leg of same. This is necessary so that the securing screws may miss the coil proper all right. Movement of the secondary coil may be arranged as indicated, by a cord passing thru a series of small eyes, as shown in the cut Fig. 2. A variable condenser is not used with this set, but a small one is easily made up of two metal tubes about 1 to 1¼" diameter, the inner tube being covered with paper and moving in and out of the fixed outer tube. The thinner the paper, the greater the capacity of the condenser. The moving tube may pass in and out thru a hole cut in the end of the cabinet.

The detector may be made out of an E. I. Co. No. 7777 stand, or just the sliding cup complete and the thumb-screw may be purchased; the bracket for same B, being made from a piece of ⅛" x ½" brass strip. The thumb screw is Cat. No. 6011, costing 15c. The sliding cup and slide are Cat. No. 7779, worth 30c. A brass spring piece C, is screwed or riveted to the standard B, as seen in Fig. 3, and a light spiral spring is soldered to this spring, C. Galena crystal is very sensitive when employed with a light "cat-whisker" contact as shown. A stiff point should be used on silicon, carborundum can be used with two fairly stiff brass springs, placing the crystal between them.

A ground electrode is composed of a metal rod and a wood handle, or a screw driver may be used. see Fig. 3.

The ground connection may be made to a water or other pipe system thoroly grounded to damp earth. A piece of wire chicken netting laid on the grass or earth, and covering about 10 to 15 square feet is also efficient. Where convenient this netting can be placed in a brook, etc.

The wiring diagram for the set is given at Fig. 4. The telephone receiver which can be any one desired from the "Electro" No. 1024-75 ohm 40 cent type up, but preferably of the best 1500 ohm No. 6667 type, can be connected across the detector or the Jr. Fixed condenser. All connections are very well made with stranded lamp cord, and the joints of the leads and the loose coupler coils are preferably soldered and taped.

When using the set, the detector is adjusted until signals are received best; but a regular *buzzer test* is of course the quickest way to adjust it; (for details see E. I. Co., Catalog No. 14). The Loading Coil switch cuts out all its inductance when the blade of same is on the 1st point. This instrument makes the set tunable for practically any commercial wave

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length up to 500 meters. The loose coupler secondary is moved in and out of the primary while tuning, and the Loading Coil switch is also tried on different positions, until the signals are received at their maximum strength.

The aerial employed may be a regular type as described in an extensive article on *Their Theory and Construction*, published in the April and May issues of "The Electrical Experimenter." Also it may be a temporary affair, made by stringing a single long wire between two trees, with an insulator connected at either end. A lead-in terminal to the set may be taken off at the end or the centre of same as desired. A wire 150 feet long may be used and if quite long it need not be erected very high above the ground. A wire 300 to 400 ft. or more long can be tried, at a comparatively low elevation above the ground, in line with some of the work recently done in this direction abroad, and also in this country. Such a set as this will prove very effective either for pleasure or serious radio work. In the city the aerial and ground terminals may be hooked up to the gas and water or steam pipes.

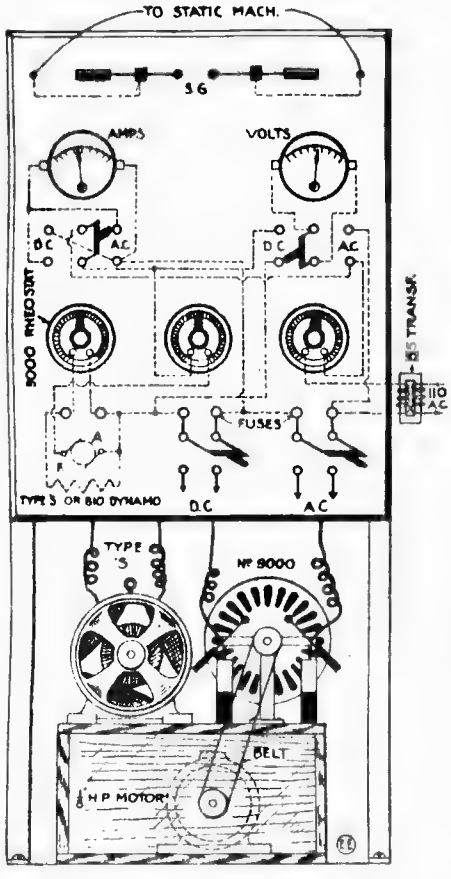
SECOND PRIZE, $2.00.

A LABORATORY SWITCHBOARD.

By Godfrey S. Bloch.

THE following is a neat and compact arrangement for the laboratory of an electrical experimenter:

Secure a box larger or smaller according to the size of the static machine used. Place a 1/16 H. P. motor in the bottom, with the pulley on the outside of the box, and build a shelf just above the motor. The (see Fig.) motor should be fastened rigidly. On the next shelf a static machine and type "SS" Dynamo should be arranged, so that either can be belted to the motor whenever desired. The spark gap of the static machine should be adjusted so that the spark will only pass thru the gap on the switchboard. The leads from these pieces of apparatus should be well insulated and led to the switchboard. A low voltage transformer is placed on the back of the box. Now to the switchboard. A switchboard is necessary in an experimental laboratory for testing apparatus, research work, etc., et cetera.



This switchboard comprises the more common instruments, familiar to all. The Rheostats may be home made. The ammeter and voltmeter are No. 1037 and 1039, which work on A. C. or D. C., and can be left in circuit continuously. The spark gap is mounted as shown. Fuses should be placed between the dynamo and switchboard, and it is good to have a small light above the instruments. The wiring is clear, and the cost is little. The new E. I. Co., catalog No. 14 just out lists thoroly suitable motors.

The board on which the instruments are mounted should be well soaked in melted paraffin if of wood. Wiring should be done with No. 14 B & S gauge rubber covered wire. All connections should be well taped and soldered. The field rheostat No. 5000 regulates the voltage of the dynamo; while the other two rheostats regulate the current in the outside A. C. and D. C. circuits respectively. The board should be held quite rigid. To have the A. C. amperes measured, the switch should be to the right of the operator; for D. C. to the left. To measure A. C. volts, the switch should be to the right of the operator; for D. C. to the left. Fig. 2 is an end view of the box; Fig. 1, a side view with the side taken out. Fig. 3 is the wiring diagram of the switchboard.

THIRD PRIZE, $1.00.

A NOVEL DETECTOR SWITCH.

MANY readers of the Electrical Experimenter have undoubtedly tried to make detector switches but most of them did not work or something else ailed them, but I have managed to make a detector switch that is very easy to operate and which is very efficient. First get a piece of hardwood, 6 inches long and 4 inches wide. Now get two pillars about 1½ inches high, and a piece of E. I. Co.'s ¼ x ¼ in. brass rod, about 5 inches long. Next drill 4 holes in the brass rod as shown in diagram. Now take your base and hammer brass headed tacks about ½ in. apart which slider is to slide over, and make contact as shown in fig. From each tack have a short piece of copper wire run to each corresponding binding post as shown. Put a number 2222 Hard rubber slider on the rod and nail down through the pillar on to the base, so that slider will pass over brass tacks nicely. The switch is completed except for a coat of varnish. It is connected up just the same as a multipoint switch only it has a binding post for buzzer test connection.

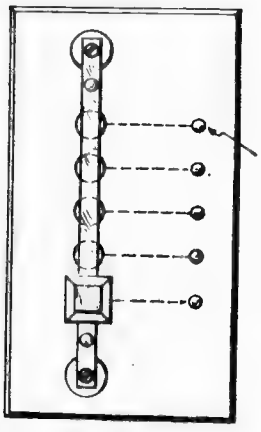


FIG. 1

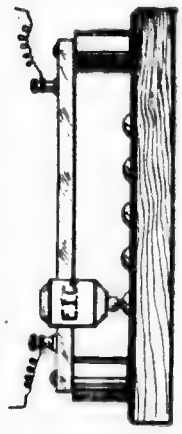


FIG. 2

List of material required. 7 E. I. Co. hard rubber binding posts; 5 in. of E. I. Co. ¼ x ¼ in. Brass Rod; 1 No. 2,222 Slider; 5 Brass Tacks; 1 Hardwood base; 2 Pillars.

Contributed by ALBERT ST. CYR.

ELECTRICITY APPLIED TO BICYCLES.

ELECTRICITY may be applied in several ways advantageously for the convenience of the 20th Century cyclist. Our sketch at Figure 1 shows an "Electro" whistle or horn applied to a bicycle, and it may be wired up very easily with a length of flexible double conductor lamp cord connecting to a battery placed in a small box, fastened in back of the seat as shown; and also to a push-button which should be placed on the handle bar so that it is within easy reach at any time. Diagram of connections which is very simple to follow, is depicted at Fig. 2. About 6 to 8 volts is best for operating the "Electro" whistle and ordinary Columbia or "Electro" dry cells of standard type may be used, and if so about 4 to 5 of them should be connected in series, e. g. carbon to zinc, etc. At Fig. 2, we show several No. 1,056 flashlight batteries, such as supplied by the "E. I. Co.," connected up so as to give 9 volts, and they are connected on series parallel as shown, to give sufficient current; as these flashlight batteries do not have a very great current capacity. It would be advisable to connect six of these cells up in series parallel after the manner shown, to give the

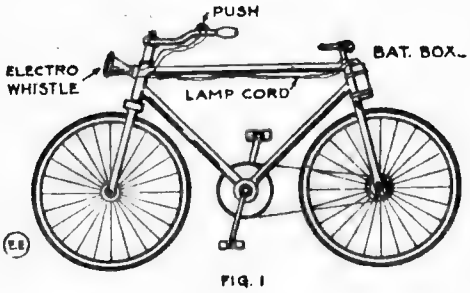


FIG. 1

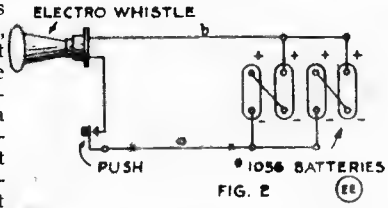


FIG. 2 EE

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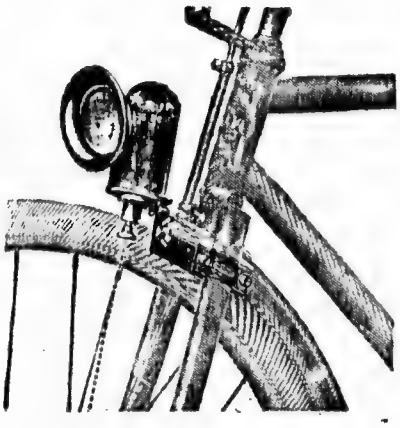
longest life. These individual batteries consist of 3 cells each, and therefore give 4½ volts a piece or 9 volts for the two in series. The lamp cord may be secured to the bicycle frame and handle bar, with ordinary friction tape or string, and a very neat job can be arranged by passing the wire thru the tubular construction of the bicycle frame itself.

Also one side of the circuit as at (a), from x to x may be a grounded circuit, made by connecting the wires at x and x, from the circuit to the metallic frame of the bicycle, which only leaves one wire to be carried along the frame or inside of the tubing of same.

One of the latest improved models of *magneto* cycle headlights; which requires no battery or other maintenance upkeep, is shown at Fig. 3. This is the "Electro" headlight, especially adapted to the requirements of owners of bicycles and motorcycles. This lamp sells at a low price, viz. $5.00, and therefore is but very little more expensive at the start than a good grade carbide lamp, and these latter lamps are always somewhat dangerous in that they may explode when least expected, and besides they of course have to be continually supplied with carbide which cost considerable, in a short while.

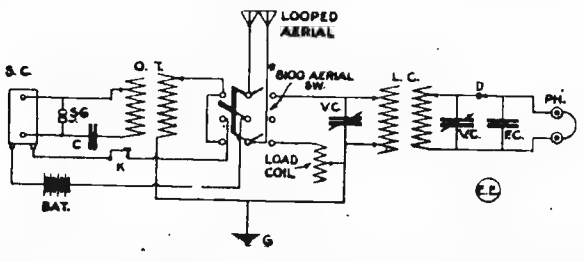
This Magneto-headlight of the improved type, consists of a miniature dynamo mounted in a highly polished nickel plated housing, and mounted on an adjustable support or bracket which is attachable to any bicycle or motorcycle frame. The head-light is fitted with a fine parabolic reflector, about 4 in. in diameter, and a powerful glass lens which throws a good beam of light over 100 feet ahead of the bicycle when same is moving at an ordinary speed of 5 to 6 miles an hour. This device is very clever indeed and must be seen to be fully appreciated. As will be evident, the dynamo in same is driven from the tire on the front wheel of the bicycle by frictional contact with a small rubber wheel placed on the end of the dynamo shaft. An extremely small amount of power is required to drive the dynamo at full speed and cannot be noticed by any cyclist. The dynamo is fitted with an automatic cut-out on the inside of same, which at a certain predetermined critical speed, cuts in a resistance unit in series with the lamp so that it will not be burned out, due to a very high speed and consequent high voltage applied to it. The voltage of such a dynamo is approximately directly proportional to the speed at which its armature is rotated. This lamp is also fitted with a simple thumb clutch on the side of same, which permits the rider to instantly swing same a few degrees away from the bicycle tire, and thus no light is given except when desired. A slight pressure on the thumb clutch immediately places the dynamo pulley in contact with the tire and a beautiful light is then had at once. This light will operate at very low speeds even when the bicycle is moving at 3 to 4 miles an hour, which of course is ordinary walking speed for the average man.



Finally the electric head-light of this type is a great improvement over gas and oil lamps of any type and in windy or wet weather it is not bothered in the least.—Contributed by Victor Arthur.

A LOOPED AERIAL SWITCHING SCHEME.

Doubtless more amateurs would use loop aerials, but owing to the necessity of an anchor gap in the lead, and the fear that their small coils would not send very far if required to jump this gap. They lose all the benefits of a loop aerial for receiving, as an aerial of this type being a closed circuit, does not reradiate energy.



By connecting a No. 8100 Aerial switch, as shown, they can use a loop aerial for receiving, and a straightway connection for sending, without the necessity of an anchor gap.

This should be of interest to all wide awake radio experimenters.

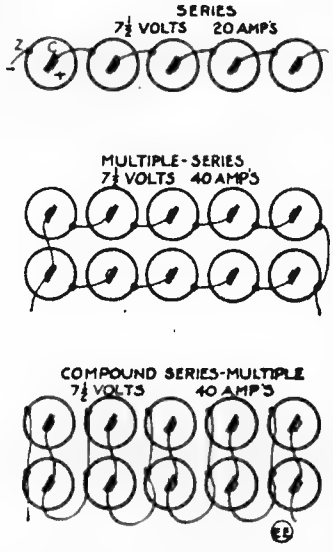
Contributed by

THOS. N. BENSON.

CONNECTING UP BATTERY CELLS.

By M. W. C.

ONE of the most frequently occurring jobs met with in electrical matters, is the connecting up of a series of dry or other battery cells. We show here three of the more common methods employed in practice. The first arrangement is the straight series circuit, which is satisfactory where a small amount of current in amperes is to be taken, as when bells, small spark coils, etc., are to be operated for a short time or intermittently. The carbon or positive terminal of each cell is joined by a piece of No. 16 or 18 copper wire, or by an "Electro" battery connector, to the zinc or negative terminal of the next cell, in each series file as will be seen clearly by the diagram. The voltage of such a series file is equivalent to the volts per cell, (1.5 volts), *times* the number of cells in series. The current or ampere capacity is that of 1 cell.



By connecting two such series files of cells on paralleled or in multiple series, as indicated in the sketch; the voltage remains as previously, but the ampere or current capacity is of course doubled. As seen the carbon terminals of each series file are connected together; likewise the zinc terminals. The compound series-multiple hook-up shown, is sometimes utilized. As will be evident there may be any number of series files connected on multiple-series or parallel, and the figuring is very simple. Hence if you want your battery to last longer and cost less for maintenance under a heavy load, connect up a duplicate or triplicate set on parallel to the first one. The same reasoning holds for dynamos of course, but it is somewhat more difficult to adjust their independent potentials or E. M. F.'s so that one dynamo will not try to carry all the load, or vice versa; thus tending to burn out the other machine.

"T. T. T." RADIO DANGER CALL.

John Burns, of London, England, president of the Board of Trade, has drawn up a merchants' shipping bill for safety at sea which will be introduced in Parliament shortly. It provides among other things for a new wireless signal T T T which is to be repeated 10 times at full power. This signal will warn vessels of imminent danger from iceberg, cyclones, etc. The T T T will not supersede the present S O S. Other urgent signals are provided for, such as "You are steaming into danger," "I want assistance," "Remain by," "I have encountered ice" and "Your lights are out."

All British ships carrying 50 or more persons must have a wireless installation.

RADIOPHONING ACROSS ATLANTIC.

Professor Elihu Thomson, said recently that it was only a question of time apparently when conversation by wireless telephone would be carried on across the Atlantic Ocean. He said that he knew of experiments with apparatus, which would soon make it possible to use a microphone transmitter to control 100-horsepower.

Professon Thomson was one of the earliest investigators of wireless transmission. He began experimenting in 1875, when he was an instructor in chemistry in the Central High School in Philadelphia. His experiments at that time were made in company with the late Professor E. J. Houston.

AMONG THE AMATEURS

RADIO CLUB OF DELAWARE.

The new wireless station at Concord Heights is completed and is a success. Recently messages were received from many government commercial stations, among which were Key West, Fla., Beaufort, N. C., Newport News, Norfolk, Va., Philadelphia Navy Yard, and the commercial stations at the Navy Yard, Philadelphia, Philadelphia and New York.

The Radio Club of Delaware, is delighted with their new station which was erected by Fred K. Felt of the Concord Heights Company and equipped with modern instruments by the Radio Club.

The Radio Club now has six U. S. Government licensed operators of which John Evans is the chief, four of which have within the last few days passed government examinations at the Navy Yard, Philadelphia.

The high elevation of the land upon which this station stands and its height, gives it a great advantage over a great many of the government and commercial stations.

T. L. Hodges of Baltimore, Md., writes the "Electro" people as follows:—

"I received my Interstate Receiving Outfit and am very much pleased with it, and you may expect another order from me in the near future."

RADIO OPERATOR AT 14.

Fred Trodson, 14, of Battle Creek, Mich., is reported the most expert wireless operator in that section. He breaks in now and then on fast professional "sending," and knows quite a bit of what is going on at wireless stations over the country. He keeps the entire neighborhood posted on the correct time by wireless, but he doesn't give out any other information that he gleans in that way, because it would be a violation of wireless ethics, and he intends to apply for an operator's license.

Young Trodson began to tinker with electricity at the age of 12. With a small "aerial" built on the roof he got in communication with other boys of the neighborhood who had similar outfits. Then he built a higher one and occasionally he could catch a word or so of messages passing between his stations.

This whetted his wireless appetite, and by doing odd jobs around town and by being economical he saved enough money to have a tower of good steel construction built in the yard at home.

The tower, 125 feet high, puts him in close touch with wireless stations all over the country.

Mr. Ralph Fraslin, 336 39th Avenue, S. W., Calgary, Alta., Canada, an E. I. Co. customer, writes them:—"I am also glad to say that I find the Electrical Experimenter very interesting, as well as instructive. You will please find herewith, coupon with three cents in stamps, for your latest catalog."

Vinton, La.

E. I. Co., N. Y.

Dear Sirs:—In an order with my friend, Robt. Mount, I got one RO 25 Receiving Set. It has proved to receive messages over 60 miles at night, which is more than it rated capacity. I remain,

Yours truly, etc.,
CLAYTON NELSON.

Don I. Shepherd of St. Johns, Kans., a satisfied E. I. Co. customer, writes us:

"Perhaps you would like to know the success I have had with the **Radioson** I purchased from you some time ago. I have a very good set, and with a clear night and quiet, I hear Colon, Key West, Sayville and Arlington. The latter two come in like thunder. I always get time from Arlington. I think the Radioson is the best detector I ever saw. There are several stations here, and there is no adjusting to do to keep it from being knocked out by the others sending."

THE UTAH RADIO ASSOCIATION.

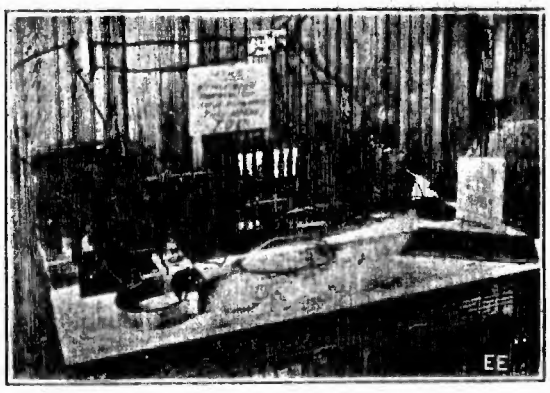
The first Wireless Association in Utah was formed in February, called "The Utah Radio Association."

The members are: Will Reynolds, President; Arnold Robinson, Sec. and Treas.; Electric Bachman, Bennett Wing, Weston Lee and George Cole.

We are not very large in membership yet, but we expect to grow rapidly.

Yours truly,
BENNETT WING.

EXPERIMENTAL RADIO STATION OF C. F. HANCOCK.



The photograph here reproduced illustrates the arrangement of a new radio experimental station installed by an E. I. Co. patron, C. F. Hancock, of Stuart, Florida. All of the apparatus is "Electro" quality, and a copy of their *catalog* and *Cyclopedia* is seen standing on the table, as well as their *Free Wireless Course*, provided with all purchases made of them. The transmitter utilizes a 6 volt, 60 ampere-hour storage battery, together with a "Bull-dog" spark coil, tuning helix, tubular condenser set, spark gap, key, etc. The receiver comprises a pair of "Amateur" 2000 ohm 'phones, Jr. type tuning coil, Universal Detector stand, No. 10000 Fixed or blocking condenser, Jr. fixed Condenser, Potentiometer, 2 dry cells, etc., et cetera. A fair size flat-top antenna is used with the set.

BOY SCOUTS BUILD WIRELESS.

Nine Boy Scouts of Sayville, L. I., have organized a Wireless Club. A number already have apparatus installed in their homes. The club will meet at the boys' homes Friday evenings. The officers, who are Fred Guldi, president; Gaston Lafferrandre, vice-president and Mortimer Brown, secretary and treasurer, all have constructed their stations.

RADIO ON THE BUNGALOW.

"Robin Nest," the popular bungalow colony near Yardley, Pa., along the Delaware, will this season be connected with Trenton, the home city of the occupants of the colony, by wireless; a station having been erected and equipped there with sending and receiving apparatus. The colony has for several years been the summer home of many prominent Trentonians. The wireless station is at the bungalow of Marvin Gregory, and will be in charge of William F. Hayes, formerly of the First Company Signal Corps, of New York City.

The receiving station in Trenton will be at the home of one of the bungalow colony members, and from it messages intended for Trentonians will be sent.

"Robin's Nest" station will have the longest receiving range of any amateur station in the East, and its aerial will contain over a half-mile of wire.

ANOTHER AMATEUR STATION.

The first wireless telegraph to be used in this section has been installed by Earl Meldrim at Edwards, N. Y. The receiver has a range of 200 miles and the sender a range of 15 miles. Mr. Meldrim had been using batteries for his generating power up to about a week ago, at which time he installed a transformer, which has reduced the voltage from electric wires to nine volts. Mr. Meldrim is working, to perfect his apparatus for long distance work and intends to secure a license to carry on interstate operating, after which he will organize a wireless club.

WIRELESS STATION CONTEST

We will inaugurate in the next issue of the "Electrical Experimenter" a **Wireless Station Contest,** open to all readers, and a monthly prize of $3.00 will be offered for the best description and photo of a wireless or electrical laboratory. Be brief and send us dark toned prints in preference to light toned ones. Write your description on separate sheet of paper.

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QUESTION BOX

This department is for the sole benefit of the electrical experimenter. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. At least one of the questions must deal with "E. I. Co." apparatus or instruments, or "E. I. Co." merchandise.
2. Only three questions can be submitted to be answered.
3. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
4. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this Department cannot be answered by mail.

Arc Lamp Voltage.

(139) Willis Gratteau, West Hampstead, N. H., inquires:

Q. 1. What is the lowest practical voltage for carbon arcs, and what kind of arc lights are those giving out a bluish hue from long glass tubes?

A. 1. Regular carbon arcs can be operated on as low as 50 to 60 volts, and the long bluish tube lights you speak of, are not arcs but Mercury Vapor Lamps which are supplied by the Westinghouse Electric & Mfg. Co., of 165 Broadway, New York City.

Q. 2. What is the average voltage of the large dynamos used in central stations in big cities like New York, and what out-put?

A. 2. The large size generators used in central stations in large cities throughout the U. S., etc., have different voltages and out-puts, according to the requirements of each individual station of course. We may say that in general, these machines give all the way from 110 volts to 10,000 volts; and they vary in out-put from a few hundred kilowatts up to 20,000 K. W. in single units, and there are several now being built with an out-put of about 30,000 K. W. each. 1 K. W. is equivalent to 1,000 watts, as also 1 Kilo-volt-ampere; which is abbreviated K. V. A.

Selenium Cells.

(140 W. M. Meacham, Morrisville, Vt., writes us:

Q. 1. What is the difference, if any, between the selenium cells, and the raw selenium in stick form supplied by the E. I. Co.?

A. 2. Answering your query No. 1, would say that the difference between the raw selenium as furnished in stick form, and selenium cells, is that the selenium cells are all made up and ready to connect into an electrical circuit with a relay, etc., while the raw selenium has to be made up into a cell, which is a rather tedious job, but may be accomplished with a little care and patience.

The July, 1913, Electrical Experimenter contains an article on the construction of selenium cells by Mr. S. Wein. The selenium in the raw state as mentioned, has different characteristics and does not act the same at all, as the selenium in the cell; as in making up these cells the selenium is slowly annealed, and it then undergoes a considerable change in its electrical properties. A one ounce of stick selenium measures about 3 x ⅜ in.

10 K. W. Radio Magnetic Speed Key.

(141) Senor Paul Kinch, So. America, asks us:—

Q. 1. Can I obtain a 10 K. W. 125 volt, 80 ampere, radio sending Key of the magnetic type for speed, from the E. I. Co.?

A. 1. A specially built 10 K. W., 80 ampere, 125 volt, magnetic breaking key together with a standard Martin Vibroplex speed sending key, will cost $30.00.

The relay or magnetic key for handling this amount of energy is designed and built with extra heavy contacts, of course.

You are undoubtedly familiar with the Martin automatic transmitting speed key which works from right to left instead of up and down, and also it sends the dots and dashes automatically, e. g. of equal length in any case, once the key has been adjusted to give dots and dashes of the length the Operator desires. Hence, great speed can be obtained with same, such as 50 to 60 words a minute without trouble; although probably with the magnetic key attachment for handling 10 K. W. the speed would be possibly cut down to 40 or 45 words a minute.

Radioson Detectors.

(142) Verner Hicks, Marion, Ill., writes the Question Dept.:—

Q. 1. I have an "Electro" Radioson Detector and the cathode or negative wire is crooked; can I bore a hole in the glass to straighten it?

A. 1. The E. I. Co., advise us that the crooked cathode wire inside the cartridge which you have, does not have to be straight; and they would not be responsible at all if you bore a hole in the cartridge as you mention. Moreover, this cathode wire simply acts as an electrical connection between the outside metal cap on the bulb, and the acid solution on the inside, the negative pole of the detector being in reality, the acid solution; and not the wire.

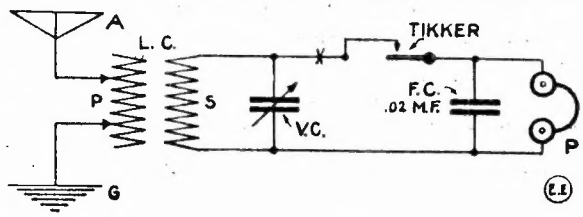
Poulson Receiving Sets.

(143) U. W. De Myer, Prescott, Ark.

Q. 1. In order to receive messages from the Federal Radio Stations sending a wave length of 2,000 meters, what other instruments will I need except the following; which I now have? 1 pair E. I. Co.'s 2,000 ohm 'phones; E. I. Co.'s Electrolytic and Silicon detectors; 1 E. I. Co.'s receiving transformer; also a large receiving transformer; 1 E. I. Co.'s loading coil; 1 Fixed Condenser (.003 M. F. Cap); 1 E. I. Co.'s Jr., Fixed Condenser; 2 small variable condensers; 1 E. I. Co.'s Circular Potentiometer; 2 Dry Batteries; 4 wire antenna, 265 feet in length, 79 feet high at lower end and 50 feet at lead-in end; iron pipe ground.

I am able to receive stations along the Coast, but have never heard Fort Worth, Texas, which is only about 150 miles distance.

A. 1. Replying to this question would advise that you will be unable to receive signals from the Federal Radio Stations with your outfit, unless you employ a tikker of some form; and for which purpose a common buzzer is commonly employed; but the Poulson tikker used on their



receiving sets, utilizes two crossed gold wires of about No. 28 B. & S. gauge, which make and break the signals at the point shown on the diagram here given. This wire is used, owing to the peculiar arcing characteristics of gold. With this hook-up or receiving arrangement, the tones of the received signals are thus controlled by the number of breaks per second made by the Interrupter or Tikker.

The Federal Station at San Francisco, utilizes a tikker or interrupter operating at about 200 breaks per second; which it has been found, gives one of the most desirable tones in the receiving head 'phones.

The fixed condenser connected across the 'phones in the diagram given herewith may have about .02 M. F. and several articles covering this Tikker, of the amateur type, have been published in the various Radio Journals available. A motor driven type, with a rotating segment mounted on a drum with properly arranged contact brush is employed extensively for commercial work. A regular telegraph relay re-arranged so that its armature can vibrate similarly to a bell, is quite serviceable for the function of a Tikker also. A crystal rectifying detector may be inserted in the circuit at X, but this is optional, and usually cuts down the strength of the received signals, but it increases their sharpness and pitch somewhat. The 'phones P, may easily be a pair of ordinary 75 ohm receivers; and Dr. de Forest has obtained very good results with such 'phones.

MICROPHONE TRANSMITTERS

(144) Willis Gratteau, West Hampstead, N. H., asks us:

Q. 1. What voltage drop would occur on a 200 yard circuit, composed of No. 14 B & S rubber covered copper wires, using a type "S S" 6 volt, 4 ampere dynamo at one end?

A. 1. The "Electro" type "S S" dynamos is entirely too small for satisfactory operation on such long circuits as those having a length of 200 yards composed of No. 14 B & S copper Conductor. One of their larger size dynamos should be used for such a long circuit, and preferably one of at least 110 volts rating.

Q. 2. How does the ordinary microphone transmitter work, such as sold by the E. I. Co.?

A. 2. When the voice air waves impinge against the metal or carbon diaphragm of the transmitter, it causes the carbon grains or balls in same to be pressed more or less tightly together, and thus changes the resistance thru the grain chamber; and these resistance variations cause the telephone line current to fluctuate in consequence, which, in turn, are manifested at the other end of the line, in the telephone receiver.

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Book Review

The Year Book of Wireless Telegraphy and Telephony. Cloth bound, 8½" x 6" x 3". 742 pages. Liberally illustrated by many half-tones and line-cuts. 1914. The Marconi Publishing Corp., New York. Price, $1.00 net.

A greatly enlarged and more comprehensive edition of the Wireless Year Book. A complete list of all radio stations is incorporated, together with a series of timely and instructive articles on radio-telegraphic matters, such as "Wireless Time Signals and Longitude" by Arthur H. Hinks, M.A., F.R.S.; "The Measurement of the Strength of Wireless Signals" by E. W. Marchant, D. SC.; "On Waves and Wave Motion," by Dr. J. A. Fleming, F.R.S., the renowned radio authority, etc. Besides, there is a vast amount of tabulated data on radio formulae, and other allied electrical matter. A Glossary of technical terms in English as well as in French, Italian, Spanish and German is given. A list of all Amateur radio clubs is appended. A list of Wireless Books and Periodicals is given; as well as a very comprehensive series of biographical notes on the leading wireless inventors. A chapter by C. E. Prince is devoted to the "Problems of Wireless Telephony." A large map is provided showing the location of all the commercial and Government radio stations in the world. All in all, the Year Book is a most valuable addition to every engineers' and experimenters' library.

TO BEAT THE EIFFEL TOWER.

The members of the International Wireless Telegraphy Commission met recently in the Royal Laeken Park in Brussels and placed the first rivet in a huge pylon to be erected there. It will be the largest in the world.

The tower, which is intended for scientific investigations of all kinds, more particularly in meteorology and wireless telegraphy, will be 1,092 feet high, or 100 feet higher than the Eiffel Tower.

INLAND NAVAL WIRELESS PLANT.

Work on the new naval wireless telegraph station at Lake Bluff, Ill., will be started immediately.

The radio station will communicate, among other points, with Panama, San Francisco, Key West, New York and Seattle. Six operators will be detailed to the station.

NEW AEROPLANE RADIO SET.

John Hays Hammond, Jr., has perfected a wireless telegraph apparatus for aeroplanes, which he intends to sell to the Government. His instrument embodies several new features which have not yet been made public, among them a new coherer twenty times as sensitive as those now in use.

This will enable aviators to receive messages as well as send them. To the present time the wireless instruments used on aeroplanes have been able only to transmit, and the inability to receive messages has kept the operators tied to their base of instructions.

Then when an aviator begins to tumble he can summon a field hospital to pitch a net under him.

England and Cairo are to be "connected" by a direct wireless system. Work has been commenced on the English station, which is to be situated at Leafield, in service of any others.

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No Matter What Your Personality May Be—The ROYAL MASTER-MODEL 10 will fit it:

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That's only *one* reason why the No. 10 Royal is the *master machine.* There are many other big, vital new features. Combined with the personality of its *regulated* touch, you get a typewriter with 100% speed—100% accuracy—100% visibility—100% durability—making 100% EFFICIENCY. A machine with 1,000 working-parts "*minus*"—a typewriter of *long-term service*, that need not be "traded out" and won't "die young."

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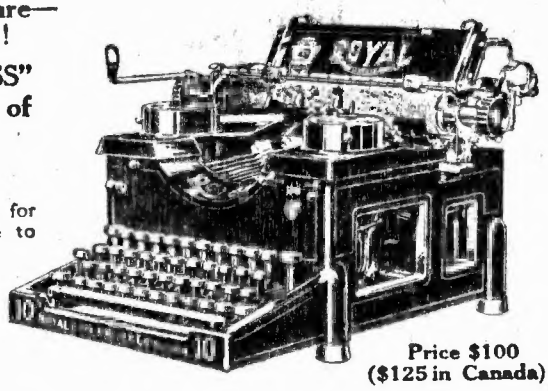

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WIRELESS

For BOY SCOUTS

No. 1313

HERE is the outfit every Boy Scout must have when in camp or at home. The outfit has a range for sending of 5 miles and for receiving of 300 miles, with a suitable aerial, yet it is so small and compactly built that **it will fit in a suit case** leaving room over. This outfit is absolutely complete in every respect and consists of the following:

1—No. 1500	Interstate Receiving Outfit (as shown on lower right)	$ 3.75
1—No. 1900	Intercity Sending Outfit with condenser, zinc, spark gap and key as shown on lower left	6.00
1—No. 1313	D. P. D. T. Knife Switch to change from transmitting to receiving outfits	.30
8—No. 9461	Insulators for aerial	.80
2 lbs. No. 9219	Antenium Aerial Wire (240 ft.)	.70
6—No. 990	Columbia Dry Cells @ 23c	1.38
1—No. 2501	Wireless Code Chart, size 9x11 inches	.10
Complete Directions and Instructions		
	Complete Boy Scout Wireless Outfit,	$12.90

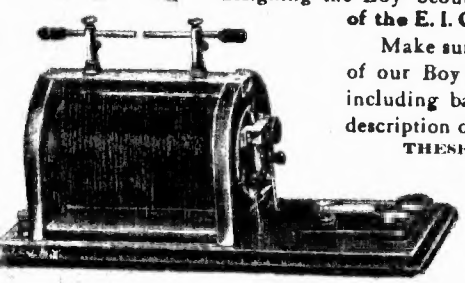
With this outfit we will furnish **for this month only** a complete copy of our famous 160 page, 20 lesson "Wireless Course" complete with cloth binder. This course contains everything worth knowing about wireless, diagrams, hook-ups, connections, codes, regulations, U. S. Laws, etc., etc.

The Boy Scout Outfit shown above has been designed especially for the Boy Scouts of America. It is substantially built to withstand service in Camp and is finely finished throughout.

In view of the fact that the Boy Scouts have certain definite needs, such as efficiency, and low price as well as portability in their outfits; all these have been kept in mind when designing the Boy Scouts Outfit and **this outfit bears the unqualified guarantee of the E. I. Co. for "Workmanship, Materials and Efficiency."**

Make sure that your troop is as well equipped as the others by having one of our Boy Scout Wireless Outfits with you. Weight of complete outfit including batteries 26 lbs. Shipping weight 35 lbs. For more complete description of outfits see catalog.

THESE LINES SHOW CONNECTIONS OF BOY SCOUT OUTFIT.



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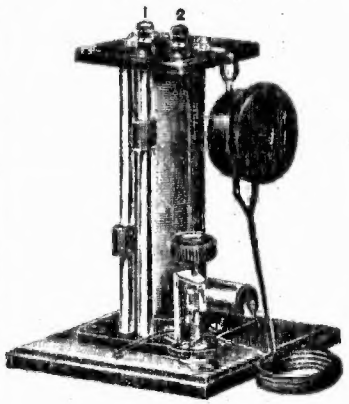
to Batteries



No. 1500

Ground

NEW CATALOGUE

The Fall catalog of the Electro Importing Co. will be off the press on July 30th. Following our custom of making our catalog more complete every year, we have rewritten, revised and added to our catalog till now it is more than ever "The Electrical and Wireless Encyclopedia." You will find all the latest news, rules, laws, etc. about Wireless, Electricity, Physics and Mechanics in it, even a metric and English ruler, besides of course the Wireless Treatise and 16 coupons for Free 160 Page Wireless Course.

You cannot afford to be without the Electrical Encyclopedia as well as the Greatest Money Saver in the U. S. so just fill out, tear off and send the corner coupon with 3c. (or 10c. if you want also code chart) in stamps to us and get a book you will keep for ever it's so valuable.

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For 10c. we will mail you prepaid a complete wireless detector exactly as illustrated, size 2½x1½x1¼", in connection with any telephone receiver and a wire on your roof. This detector is guaranteed to receive messages from 100 to 500 miles. Complete instructions furnished. This detector is no toy but does exactly the same work as a $10.00 instrument. If you have no receiver get our 75 ohm Pony telephone receiver for 50c. prepaid. Detector and Receiver 60c. prepaid. Your money back if dissatisfied.
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